A Dissertation on

A STUDY OF SURGICAL INDICATIONS IN TRAUMATIC TEMPORAL LOBE LESIONS OF ADULTS

M.Ch. Degree Examination
Branch II Neurosurgery

MADRAS MEDICAL COLLEGE
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CERTIFICATE

This is to certify that the dissertation entitled **"A STUDY OF SURGICAL INDICATIONS IN TRAUMATIC TEMPORAL LOBE LESIONS OF ADULTS"** was done under our supervision and is the bonafide work of Dr.C. RAMASAMY. It is submitted in partial fulfillment of the M.Ch Neurosurgery Examination.

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CONTENTS

AIM

A) To study the surgical indications, apart from radiological features of herniation and anisocoria, in choosing between surgical and non surgical methods of management-with special accent on parenchymal lesional volume.

B) To evaluate the importance of bradycardia and long tract signs in these patients.

INTRODUCTION

Traumatic Temporal lobe lesions are a common type of Traumatic brain injury (TBI), comprising as much as 20% of operative intracranial lesions in representative series.

In pre CT era, Temporal lobe lesions were diagnosed rarely in alive patients based on the clinical picture alone. It is unfortunate since it is an easily preventable cause of mortality.

Improvement in diagnostic methods, management protocols and treatment modalities have resulted in substantial reduction in mortality and morbidity, and improvement in outcome.

Traumatic Temporal lobe lesions are most important, because of their location near to the tentorial hiatus, and thereby they are liable to cause rapid deterioration due to herniations. Hence, it is important to have clear cut management protocols, conservative or surgical in the management of Traumatic Temporal lobe lesions.

This study was under taken to identify the factors which will help to choose between definitive conservative management and surgical intervention.

Broadly there is no controversy in the management, when the patient has deteriorated clinically when on conservative management, or when patient present with features of herniation and anisocoria. But when the patient's level of consciousness is stable, there is no unanimous opinion regarding the size of the clot / lesion that will warrant surgical intervention. And also, there is no unanimous opinion on the extent of deterioration in coma score to warrant surgery.

Another grey area is the amount of importance to be given to bradycardia and long tract signs in the management of these patients, in the absence of anisocoria and radiological signs. This study aims to address these questions in particular.

Gallbraith and Teasdale (1981) stated that if those who are going to deteriorate could be identified soon after the lesions have been detected, they could be operated upon immediately without incurring risks of delay, and the remainder would be spared of unnecessary operation.

This study is undertaken to identify the critical volume of traumatic temporal lobe lesions which will indicate surgery, in the management of traumatic temporal lobe lesions, before clinical deterioration.

In addition, this study also attempts to quantify the fall in GCS score which will call for surgical intervention.

Yet another attempt of this study is to reevaluate the importance to be given to the presence of bradycardia and long tract signs in these patients.

REVIEW OF LITERATURE

Temporal lobe is commonly injured in head trauma because of its vulnerable situation in the skull when injury is mild, it may not manifest clinically. When injury is severe it can produce significant mass effects, leading to raised intracranial pressure and neurological deterioration of the patient. However, the management choices in these candidates are still in ambiguity.

According to Tandon [17] (1978), traumatic temporal lobe lesion forms a major group among head injuries which require surgery.

In a large multicentre prospective study containing 1107 patients, conducted by Gennarali[(5)] (1982) et al, he concluded that lower GCS strongly correlated with poor outcome. They also pointed out that, outcome mainly depends on the characteristics of hematomas and also the severity of the injury as measured by GCS.

Generrali[5] (1982) et al in a prospective study comparing standardized surgical treatment protocols with conservative treatment protocols concluded that the most significant predictor of outcome was GCS on post trauma day one. They also predicted that decompressive craniotomy is the best treatment modality for patients with resistant intracranial hypertension.

Lobato[13] (1983) et al in a pioneering study concluded that final outcome was accurately predicted by CT Scan taken at 12 hrs than the initial CT Scan diagnosis 20% of his patients had an initial normal CT Scan.

Andrews[1] (1988) et al showed that patients with temporal lobe ICH of 30cm3 (or) more defined by the product of Anteroposterior, Mediolateral, Superoinferior dimensions on CT Scan were likely to develop brain stem compression and tentorial herniation, implying that these patients should undergo early surgery and evacuation of the offending mass lesion.

Bullock[2] (1989) et al in his prospective study of intracranial hematoma managed conservatively, concluded that Basal cistern effacement on initial CT Scan is an indication for surgery – regardless of GCS and Clot volume. He also concluded that peak intracranial pressure was the strongest predictor of outcome. He studied the effect of the hematoma size, degree of edema, GCS, basal cisterns and peak ICP with respect to temporal lobe hematomas and

concluded that all the above factors significantly correlated with the final outcome.

Yamaki[21] (1990) et al studying evaluation of Temporal lobe Hematomas > 3 cm in diameter, concluded that 84% of these patients reached the maximal hematoma size within the first 24 hrs. He further concluded that all the hematomas > 3cm in diameter developed within the first 24 hrs.

Kofwica and Jokubowsi[10] (1992) in a retrospective study conducted in patients above 70 years of age, concluded that initial admission GCS strongly predicted the final outcome. They also felt thatfor patients above 70 years with an initial GCS less than 9, limited attempts should be made for resuscitation, intensive care and surgery.

Tseng[19] (1992) et al predicted that addition of Temporal Lobe excision with standard surgical procedure improved the outcome.

Zumkeller[22] (1992) et al comparing surgical and non surgical management of temporal lobe hematomas, concluded that no statistical difference existed in outcome between the operative and non operative groups.

Choksey[3] (1993) et al in a retrospective study of 200 patients with temporal lobe ICH, conducted to ascertain the factors influencing outcome, concluded that probability of clinical deterioration significantly increased when initial clot volume was > $16cm^3$. Respiratory insufficiency, low GCS, and hematoma volume > $16cm^3$ predicted poor outcome. Craniotomy significantly improved the outcome for the above patients.

Lee[12] (1995) et al in his retrospective study found that the addition of Temporal Lobectomy in standard surgical technique significantly reduced the mortality and improved the outcome.

Kumchev[11] (1998) et al in a retrospective analysis comprising surgical and non surgical treatments for temporal lobe hematomas and concluded that eventhough surgically treated patients showed clinical improvement, surgery did not alter the mortality rate.

Munch[15] (2000) et al in his retrospective study concluded that more than 50 years of age with GCS > 8, had better outcome. He also concluded that patients whose craniectomy edge bordered upto the base of the middle cranial fossa had improved Mesencephalic cistern visibility and reduced midline shift, which significantly improved the final outcome.

Mathiesen[14] (2000) et al reviewed 218 traumatic brain injury patients and concluded that patients with temporal contusion with GCS $\geq$ 6 and lesion

volume $\geq$ 50CC had better outcome with early surgery or surgery immediately following deterioration, than without surgery or with delayed operation.

Patel[16] (2000) et al studying patients initially managed conservatively, and who later required craniotomy predicted that majority of these patients deteriorated within first 24 hours.

Thus we see that, though there are many prospective and retrospective studies in the management of Traumatic intracranial lesions in general, the literature with regards to Traumatic Temporal lobe lesions alone is limited. Even among these studies, it is not clear whether the described threshold lesion volume for surgery was arrived as a stand alone factor or lesion volume with radiological signs of herniation. Most of the studies give a range of 30-50ml as a threshold volume for surgery. We feel it is important to identify a threshold lesion volume for surgery, prior to the onset of clinical or radiological signs of herniation to avoid secondary brain damage and its sequalae as a result of herniation.

Further it is also noted that, when a patient deteriorates under conservative management, there is no quantification of the GCS Score fall which will call for surgical intervention.

The literature is also silent on the importance of long tract signs and bradycardia in these patients.

STUDY MATERIALS AND METHODS

This study was conducted on randomly selected patients admitted with a diagnosis of traumatic temporal lobe lesions between September 2004 and February 2007 at the Institute of Neurology, Madras Medical College, Govt. General Hospital, Chennai. A total number of 115 patients were enrolled for the study.

A total of 15 patients were excluded from this study based on the below mentioned exclusion criteria. The remaining 100 patients were enrolled for this study.

EXCLUSION CRITERIA

1) Patients who were initially admitted in another hospital and then later referred here, due to lack of exact information regarding initial clinical condition of the patients.
2) Patients who were not willing for surgery when indicated.
3) Patients who could not be operated, because of poor hemodynamic status.

4) Patients with known bleeding diathesis.

5) Patients with comorbid medical illness which may influence the outcome.

6) Patients with other Brain Parenchymal Injuries

7) Patients clinically brain dead.

8) Patients with lesion volume of <30ml, if they straightaway presented with clinical or radiological signs of herniation were excluded for the study purpose.

9) Patients with other system injuries which would influence the outcome.

10) Patients with bilateral temporal lobe lesions .

INCLUSION CRITERIAS

- Unilateral

- pure temporal lobe

- Adults

A proforma was formulated to conduct this study and all these patients were enrolled for the study, had their necessary parameters filled up in the proforma. The proforma contained all the necessary informations required for conducting the study.

All the patients admitted were initially evaluated for their post resuscitation GCS, age, sex, presence (or) absence of bradycardia, Cranial Nerve involvement and long tract signs. A complete Neurological examination was conducted whenever possible.

All the patients were subjected to CT Scan brain (plain) with Bone Window.

First CT Scan brain was done within 2 hours of trauma, and all the surviving patients under went CT Scan Brain after 6 hours and 24 hours.

CT Scan images of volume of the lesions in ml, presence (or) absence of midline shift, measurement of midline shift when present, and presence (or) absence of Basal Cistern effacement were noted in all cases.

CT Scan Volume of the lesion is measured in ML by using the

formula = $4/3\ \Pi \times \frac{a \times b \times c}{2}$

= $\frac{4.189 \times a \times b \times c}{2}$ (Orrison's Neuroimaging)

a = Anteroposterior Dimension

b= Mediolateral Dimension

c= Superoinferior Dimension.

After evaluation, some patients (Total of 29) were subjected for surgical intervention on the basis of following Radiological criteria irrespective of the GCS.

Lesion volume >30ml, Midline shift >5mm, Basal cistern effacement.

In addition to the above definite parameters, presence or absence of bradycardia, presence (or) absence of long tract signs and cranial nerve involvement were noted.

Remaining 71 patients were initially managed conservatively

In addition we have attempted to measure supratentorial cranial volume, inorder to arrive at a critical volume index for supratentorial lesions. We have compared equal number of adult male and female skulls and obtained an average.

Taking the mean average of Supratentorial Cranial Volume (STCV) in our population, we have arrived at critical lesional index as follows;-

$$\text{Supratentorial Temporal Lobe lesion Index} = \frac{\text{Lesion Volume}}{\text{STCV}}.$$

All patients planned for surgery were assessed for their anaesthetic fitness based on hemodynamic status and blood parameters. They were subjected to surgery immediately. A standard fronto temporo parietal decompressive craniotomy and clot evacuation was done on the relevant area and side. In all cases, Dura was left open and bone flap removed.

Based on the above information a master chart was prepared. A critical statistical analysis of the master chart was done using

i) Contend analysis

ii) Chi-square test

iii) One way Anova

iv) Independent T Test

v) Inter correlation Matrix, and the results are discussed in the following pages.

PROFORMA

1) Name : Date & Time of Injury

2) Age : Date & Time of Admission

3) Sex : Date & Time of Surgery

4) IP No. : Date of Discharge / Death

5) MIN No. :

6) Mode of injury:

7) GCS : On admission (on deterioration) (on discharge)

8) No of CT Scans done

CT Findings

Time: < 2hr 6hr 24hr on deterioration

Volume : (in ml)

Midline shift (+ > 5mm

- No shift / < 5mm)

9) Bradycardia (+ Present

- Absent)

10) Cranial Nerves involvement (+ Present
- Absent)

11) Long Tract Signs (+ Present

- Absent)

12) Outcome (Alive / Dead)

13) Group of the Patient

RESULTS & ANALYSIS OF RESULTS

On analyzing our data based only on the lesion volume we identify three groups in our study population.

Group –I: These patients had presenting volume of 30ml or > 30ml and underwent direct surgical management(Mortality 17.2%)
Majority improved.

Group –III : These patients had presenting volume of 10ml or below.

Group- II : These patients had presenting volume between 10-30 ml. There are 2 sub groups in this category.

Group –IIa : On periodical CT Scan, these patients had increased lesion volume of 30ml and underwent surgery.(Mortality 16.7%)

Group – IIb : These patient's lesion volume never exceeded 30ml and hence were managed conservatively.(Mortality 58.31%).

This study addresses the management of Group IIb patients where there was maximum mortality rate, due to lack of clear cut guidelines for surgery.

Group – I : had 29 patients

Group - IIa : had 24 patients

Group – IIb : had 12 patients

Group – III : had 35 patients

It is interesting to note that patients in group I and group IIa had Radiological Signs of herniation. Thus it appears that those papers which advocate the lesion volume of 30ml, 50ml as an indication for surgery perhaps also had radiological signs of herniation as criteria for surgical management though they do not say exclusively.

Our study concentrates on lesion volume alone as an independent factor for indication of surgery before the radiological signs of herniation sets in, so that secondary injury to the brain can be avoided.

Likewise, we also assessed among the clinical criteria, the role of bradycardia and long tract signs as independent factors for surgical intervention. Thus it is seen that the prevalence of bradycardia and long tract signs increases, as the lesional volume increases.

The results are analysed in the following tables.

TABLE – 1

ANALYSIS OF LESION VOLUME AMONG THE STUDY GROUPS

Group	I	IIa	IIb	III	Total
Volume (in ml)	38.75 ± 4.43	18.62 ± 3.95	21.41 ± 1.72	8.88 ± 2.60	21.39 ± 12.54

- Average volume for the study Group is 21.39 ml
- Average Volume of Group III was the least, < 10ml. Where as group I had highest Average Volume of 38.75ml

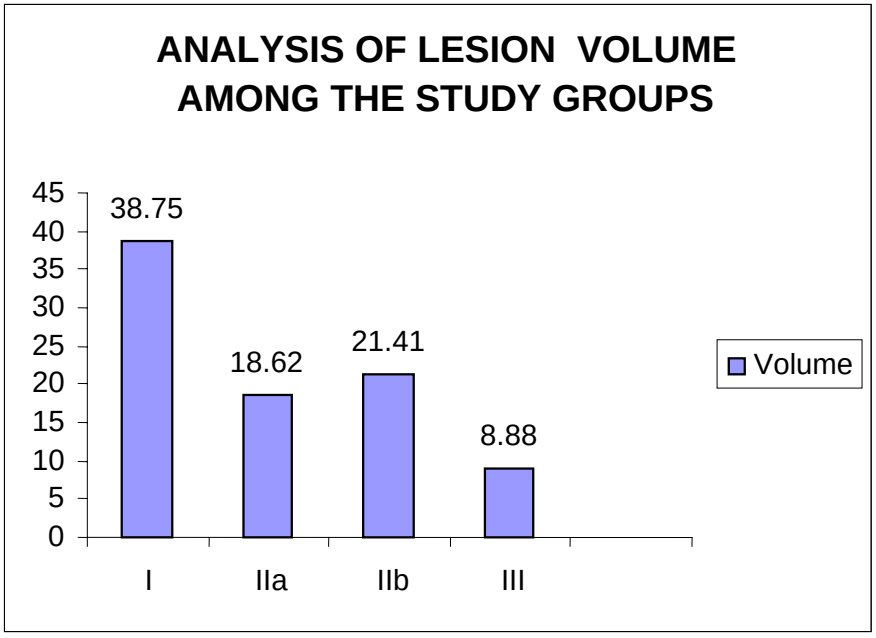


TABLE – 2

COMPARISON OF OUTCOME AMONG THE GROUPS

Group	I	IIa	IIb	III
Alive	24 (82.8)	20 (83.3)	5 (41.7)	33 (94.3)
Dead	5 (17.2)	4 (16.7)	7 (58.3)	2 (5.7)

- Mortality rate is highest in Group -IIb patients, where as other Groups had lesser mortality rate.

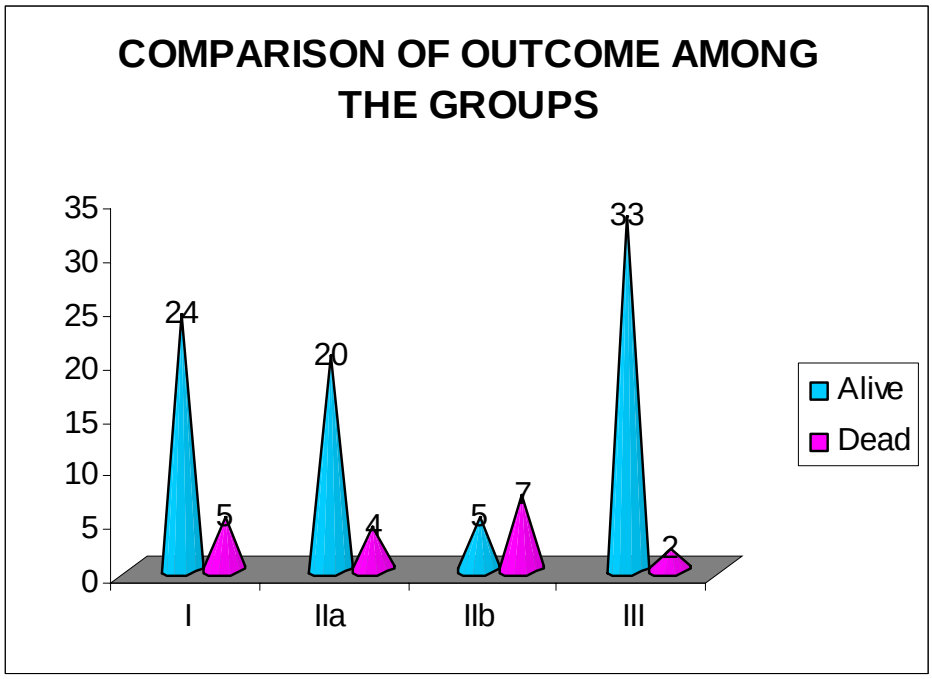
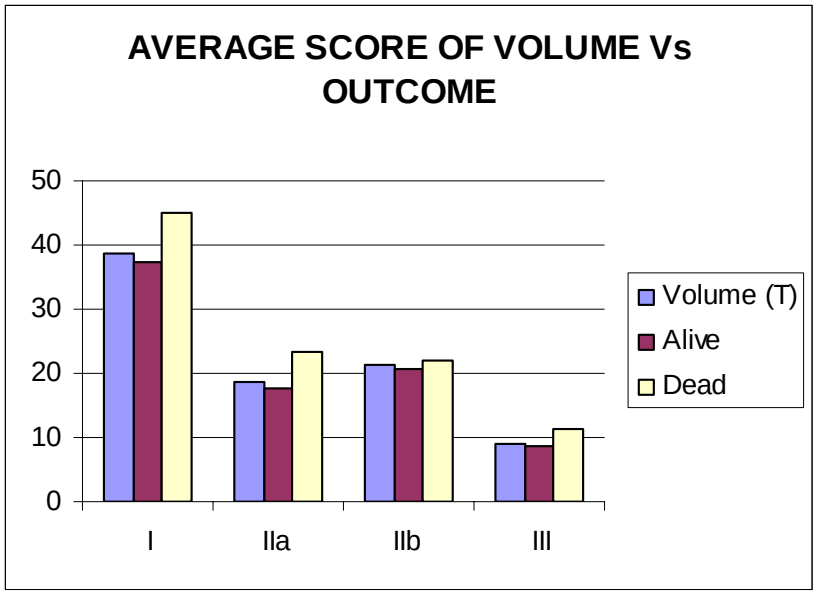


TABLE – 3

AVERAGE SCORE OF VOLUME Vs OUTCOME

Group	I	IIa	IIb	III
Volume (T)	38.75 (29)	18.62 (24)	21.41 (12)	8.88 (35)
Alive	37.45 (24)	17.65 (20)	20.80 (5)	8.72 (33)
Dead	45.00 (5)	23.50 (4)	21.85 (7)	11.50 (12)



- Average Score of volume in alive patients in Group – I was 37.45, and in Group – IIa and Group IIb was 17.65 & 20.80 respectively.

- Average Score of volume in Dead Patients in Group – I was 45.00, and in Group IIa & IIb was 23.5 and 21.85 respectively.

TABLE – 4

VOLUME (and) Vs MIDLINE SHIFT

Group	I	IIa	IIb	III
No Shift (-)	-	18.95	21.41	8.88
(Shift >5mm) (+)	38.75	15.00	-	-

In Group-I average score of volume is 38.75ml causing midline shift >5mm.

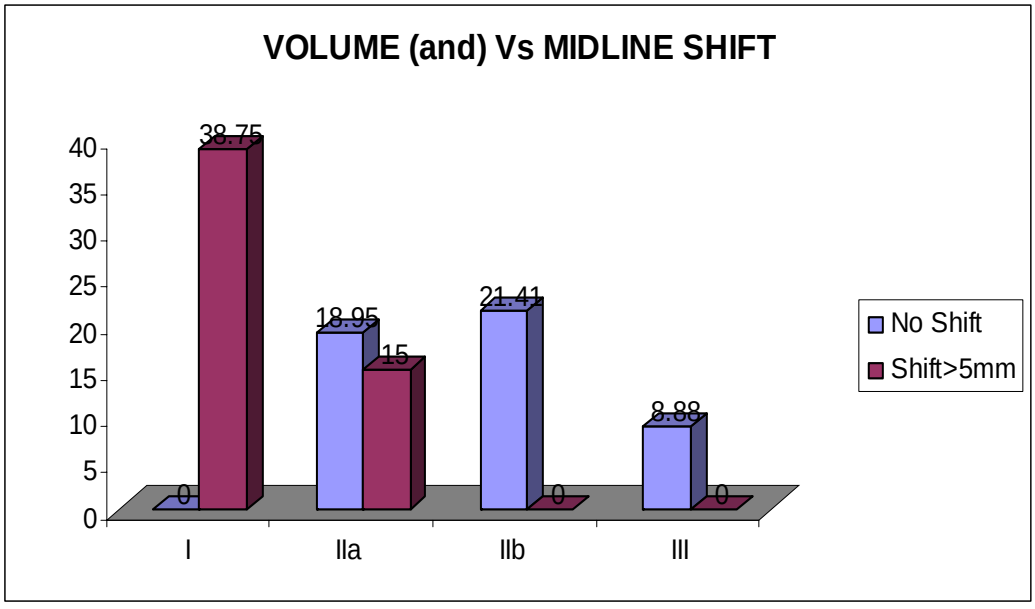


TABLE – 5

VOLUME Vs CISTERNAL EFFACEMENT

Group	I	IIa	IIb	III
Cistern (-) Effaced	38.75	17.16	20.66	-
(Seen /Not effaced) (+)	-	23.00	23.66	8.88

Average volume score was 38.75ml in Gr-I patients with cisternal effacement. In IIa and IIb cisternal effacement was present when average volume score was 17.16ml and 20.66ml respectively.

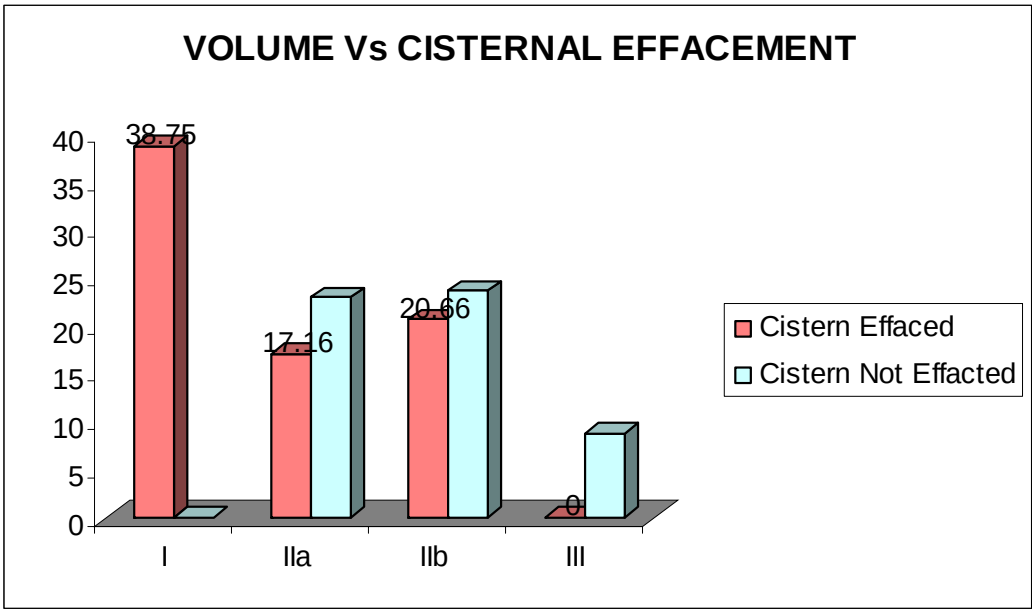


TABLE – 6

VOLUME Vs CRANIAL NERVE INVOLVEMENT

Group	I	IIa	IIb	III
Cranial Nerves (Not Involved) (-)	38.07	17.68	21.00	8.84
(Involved) (+)	39.10	20.58	21.50	9.33

Average volume score in Gr-I patients with cranial nerve involvement was found to be 39.10ml. In Gr-II a / IIb it was 20.58ml and 21.50ml respectively.

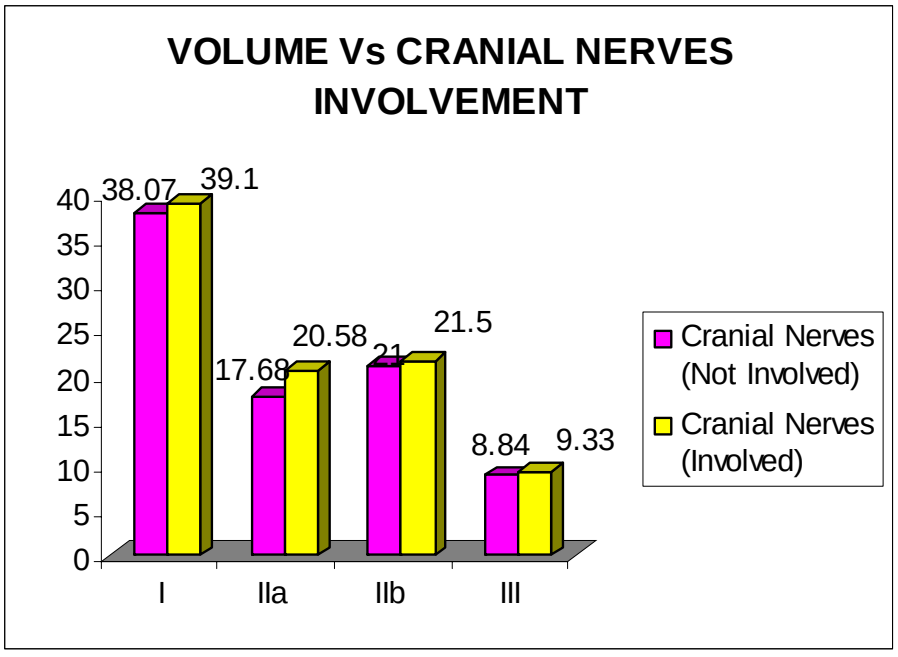


TABLE – 7

VOLUME Vs BRADYCARDIA

Group	I	IIa	IIb	III
Brady (Absent) (-)	38.88	19.30	20.00	8.93
(Present) (+)	38.58	18.17	21.88	8.33

Bradycardia was present in Gr-I patients whose average volume score was 38.58ml but it was 18.17ml and 21.88ml in Gr-IIa / IIb respectively. Gr-III was the least with 8.33ml.

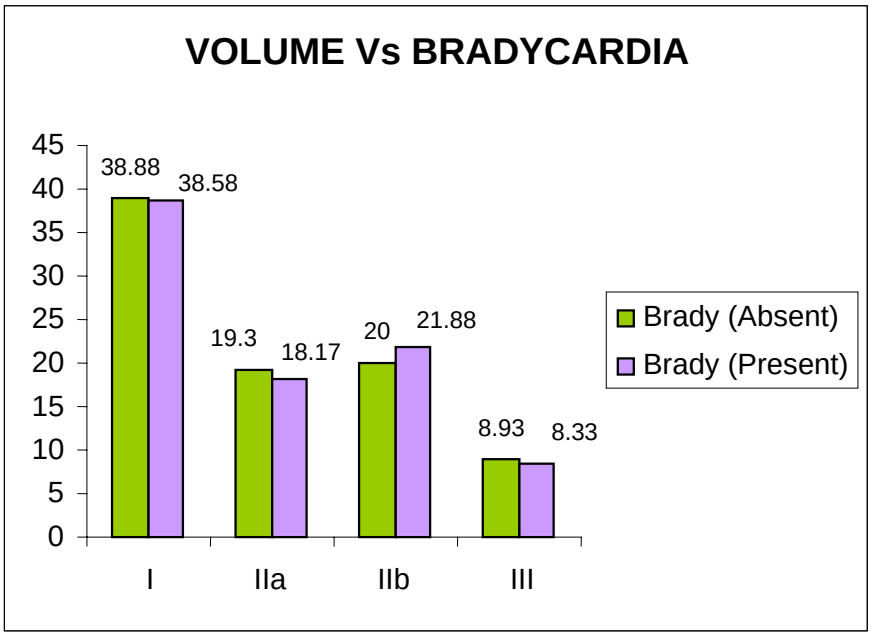


TABLE – 8

VOLUME Vs LTS

Group	I	IIa	IIb	III
LTS (Absent) (-)	37.26	17.85	21.00	8.70
(Present) (+)	41.60	18.94	21.62	15.00

LTS involvement seen in Gr-I patients when the average volume score was 41.60ml but in Gr-IIa (18.94ml), Gr-IIb 21.62ml and in Gr-III 15.00ml.

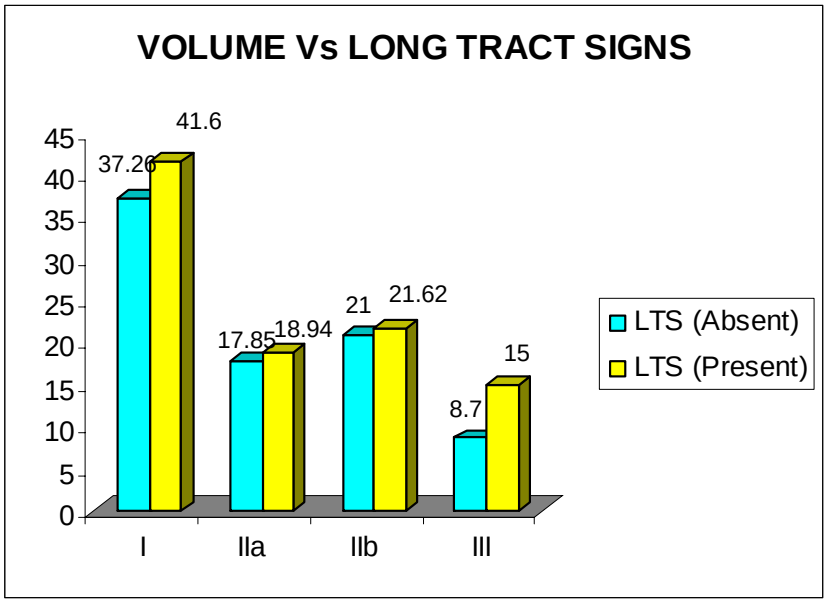


TABLE – 9

VOLUME Vs OUTCOME

Group	I	IIa	IIb	III
Alive	37.45	17.65	20.80	8.72
Dead	45.00	23.50	21.85	11.50

Average volume score in death patients was found to be the highest in Group I and it was 45.00ml.

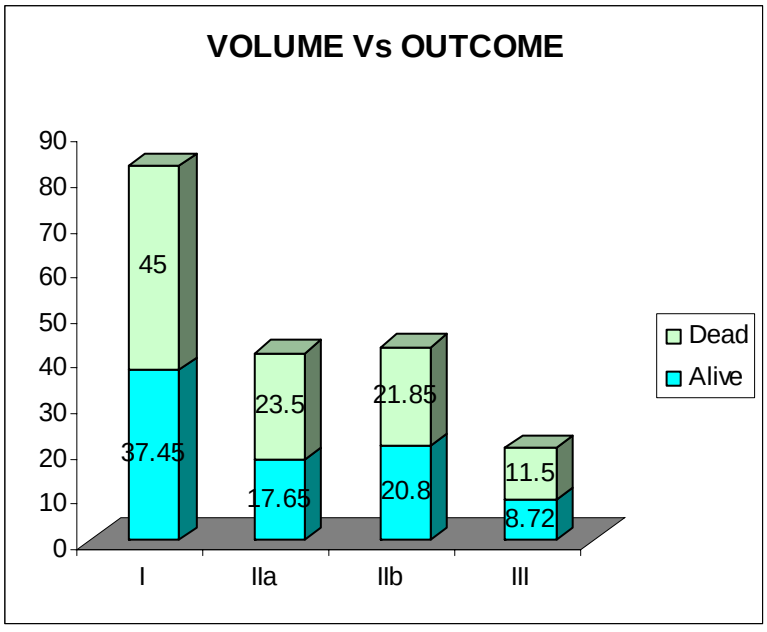


TABLE – 10

GCS (Initial) Vs OUTCOME

Group	I	IIa	IIb	III
Alive	7.66	12.80	12.80	13.81
Dead	6.00	11.00	13.28	14.50

Average volume score in relation to initial GCS in alive patients was 12.8ml and 12.8ml in Gr.IIa / IIb respectively.

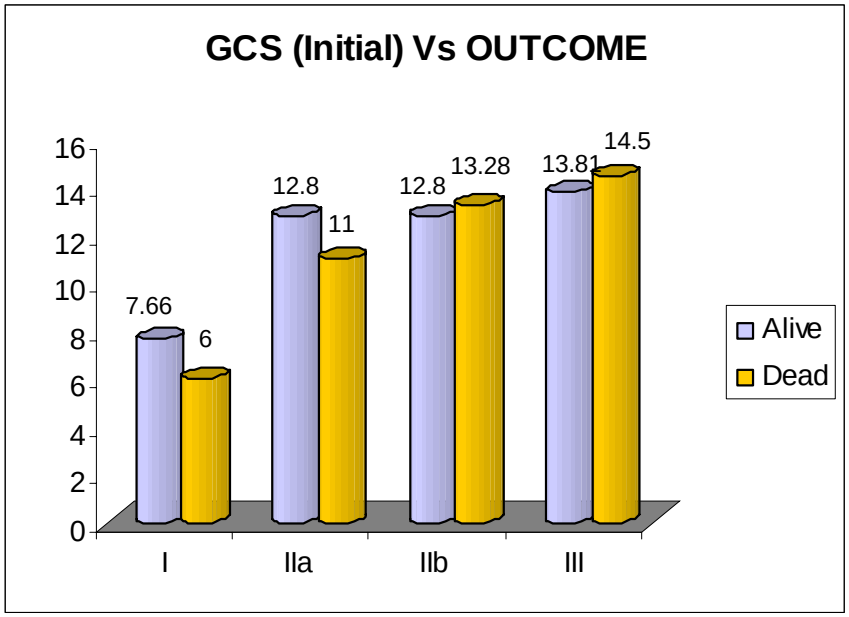


TABLE – 11

GCS (Deterioration) Vs OUTCOME

Group	I	IIa	IIb	III
Alive	-	10.35	11.00	-
Dead	-	9.25	11.71	-

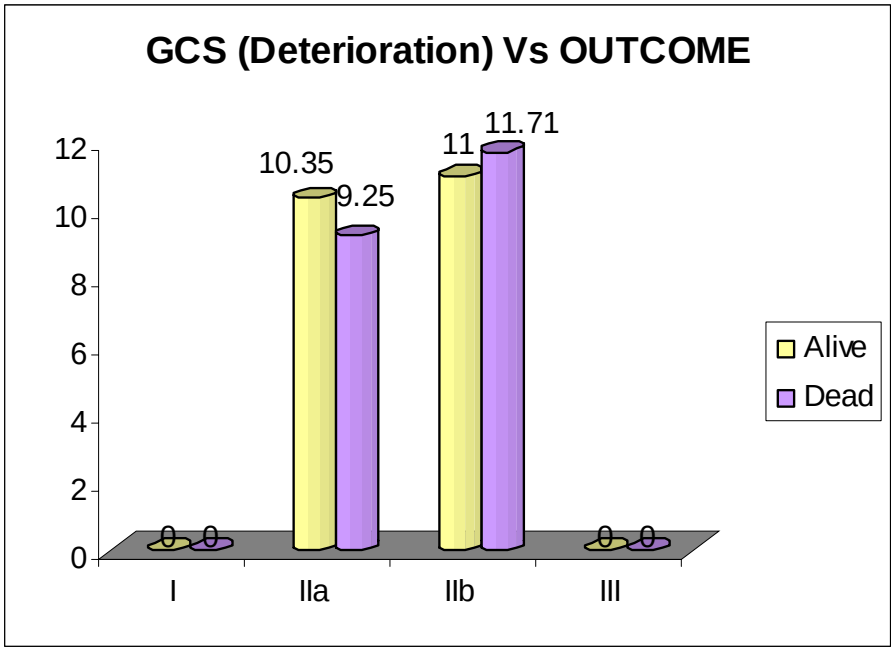


TABLE – 12

PREVALENCE OF MIDLINE SHIFT IN VARIOUS GROUPS

Group	I	IIa	IIb	III	Total
Midline Shift (-) Absent	0	22(91.7)	12(100.0)	35(100.0)	69(69.0)
Midline Shift (+) Present (> 5mm)	29(100)	2(8.3)	-	-	31(31.0)
Total	**29(29.0)**	**24(24.0)**	**12(12.0)**	**35(35.0)**	**100(100.0)**

- 31% of the patients had Midline Shift
- In Group I, 100% of patients had Midline Shift > 5mm
- Group IIa, 8.3% of patients had Midline Shift > 5mm
- Group IIb & III, no Midline Shift.

TABLE – 13

The above results were analysed statistically as below:-

Analysis	***Value***	***DF***	***Significant***
Pearson Chisquare	91.42902	3	.00000
Likelihood Ratio	110.05201	3	.00000
Mantel – Haenszel test for linear association	62.47036	1	.00000
Minimum Expected Frequency	3.720		
No. of valid cases	100		

Statistically significant.

TABLE – 14

PREVALENCE OF BASAL CISTERN EFFACEMENT IN VARIOUS GROUPS

Group	I	IIa	IIb	III	Total
Cistern not seen (-)	29 (100.0)	18(75.0)	9(75.0)	-	56(56.0)
Cistern seen (+)	-	6(25.0)	3(25.0)	35(100.0)	44(44.0)
Total	**29(29.0)**	**24(24.0)**	**12(12.0)**	**35(35.0)**	**100(100.0)**

In Group I, 100% of patients had Cisternal Effacement.

In Group IIa & IIb, 75% of patients had Cisternal Effacement.

In Group – III, No Cisternal Effacement

Almost half of the patients in the study group had effacement of cisterns

The above results are analysed statistically.

ON ANALYSIS

TABLE – 15

Analysis	***Value***	***DF***	***Significant***
Pearson Chisquare	72.60552	3	.00000
Likelihood Ratio	96.69783	3	.00000
Mantel – Haenszel test for linear association	64.85176	1	.00000
Minimum expected frequency	5.280		
No. of Valid Cases	100		

Presence or Absence of Cisternal effacement was a statistically significant factor in all the groups. They played a vital role in decision making about the surgical intervention or conservative.

TABLE – 16

PREVALENCE OF CRANIAL NERVES IN VARIOUS GROUPS

Group	I	IIa	IIb	III	Total
CrN not involved (-)	19 (65.5)	16 (66.7)	2 (16.7)	32 (91.4)	69 (69.0)
Cranial Nerve Involved (+)	10 (34.5)	8 (33.3)	0 (83.3)	3 (8.6)	31 (31.0)
Total	**29 (29.0)**	**24 (24.0)**	**12 (12.0)**	**35 (35.0)**	**100 (100.0)**

- 69 of the total 100 Patients did not have Cranial Nerve Involvement.

  The remaining patients had cranial nerve involvement.
- Group – I, IIa, III showed cranial nerve involvement ranging from 31 to 33% while IIb showed, No cranial nerve involvement.

ANALYSIS

TABLE – 17

Analysis	*Value*	*DF*	*Significant*
Pearson Chi-square	23.82150	3	.00003
Likelihood Ratio	24.61562	3	.00002
Mantel – Haenszel test for linear association	3.29274	1	.06959
Minimum expected frequency	3.720		
No. of Valid Cases	100		

Statistically significant.

TABLE – 18

PREVALENCE OF BRADYCARDIA AMONG THE STUDY GROUPS

Group	**I**	**IIa**	**IIb**	**III**	**Total**
Absent (-)	17 (58.6)	10 (41.7)	3 (25.0)	32 (91.1)	62 (62.0)
Present (+)	12 (41.4)	14 (58.3)	9 (75.0)	3 (8.6)	38 (38.0)
Total	**29** **(29.7)**	**24** **(24.0)**	**12** **(12.0)**	**35** **(35.0)**	**100** **(100.0)**

- A total of 38 patients among the study Group had Bradycardia.
- In Group I & IIa patients had more (or) less similar percentage of presence of bradycardia.
- Percentage of Bradycardia was found to be highest in IIb Group Patients, where ¾ was positive.
- In Group III it is found to be the least.

ON ANALYSIS

TABLE – 19

Analysis	***Value***	***DF***	***Significant***
Pearson Chi-square	24.19069	3	.00002
Likelihood Ratio	26.90376	3	.00001
Mantel – Haenszel test for linear association	8.07320	1	.00449
Minimum expected frequency	4.560		
No. of Valid Cases	100		

Statistically significant.

TABLE – 20

PREVALENCE OF LONG TRACT SIGNS AMONG STUDY GROUPS

Group	**I**	**IIa**	**IIb**	**III**	**Total**
Absence of LTS (-)	17 (58.6)	10 (41.7)	3 (25.0)	32 (91.4)	62 (62.0)
Presence of LTS (+)	12 (41.4)	14 (58.3)	9 (75.0)	3 (8.6)	38 (38.0)
Total	**29 (29.0)**	**24 (24.0)**	**12 (12.0)**	**35 (35.0)**	**100 (100.0)**

- Presence of LTS among the Study Groups were almost similar like bradycardia.

ON ANALYSIS

TABLE – 21

Analysis	*Value*	*DF*	*Significant*
Pearson Chi-square	24.19069	3	.00002
Likelihood Ratio	26.90376	3	.00001
Mantel – Haenszel test for linear association	8.07320	1	.00449
Minimum expected frequency	4.560		
No. of Valid Cases	100		

Statistically significant.

TABLE – 22

PREVALENCE OF AGE AMONG THE STUDY GROUPS

Group	I	IIa	IIb	III	Total
Age	45.51 ± 12.37	43.12 ± 17.04	33.91 ± 11.85	40.97 ± 13.90	41.96 ± 14.32

- Average age of the Study Group was around 40 years, which was same for all Groups.

TABLE – 23

GCS AMONG STUDY GROUPS

Group	I	IIa	IIb	III	Total
GCS Initial	7.37. ± 3.08	12.50 ± 1.58	13.08 ± 0.77	13.85 ± 0.77	11.56 ± 3.32
Deterioration	-	10.16± 3.3	11.41 ± 0.90	-	3.81 ± 5.37

- Average initial GCS for the entire Study Group found to be 11.
- Group I patients had significantly lower initial GCS than average
  - when compared with remaining 3 Groups whose GCS was higher than the study Group average – but the difference was minimal

On analysis of post deterioration GCS, Group IIa & IIb patients had lower GCS when compared to average post deterioration initial GCS of Study Group.

On comparing initial GCS with post GCS of IIa / IIb patients, both Groups had deteriorated by 2 scores on an average which again is a significant finding.

TABLE – 24

ANOVA

Initial GCS

	Sum of Squares	**DF**	**Mean Square**	**F Ratio**	**Significant**
Between Groups	740.6100	3	246.8700	67.3225	.0000
Within Groups	352.0300	96	3.6670		
Total	1092.6400	99			

Significant

TABLE – 25

ANOVA

Deterioration GCS

	Sum of Squares	**DF**	**Mean Square**	**F Ratio**	**Significant**
Between Groups	2593.1400	3	864.3800	314.0226	.0000
Within Groups	264.2500	96	2.7526		
Total	2857.3900	99	-		

Significant

TABLE – 25

ANOVA

VOLUME

	Sum of Squares	**DF**	**Mean Square**	**F Ratio**	**Significant**
Between Groups	14404.3951	3	864.3800	314.0226	.0000
Within Groups	264.2500	96	2.7526		
Total	2857.3900	99			

Significant

TABLE – 26

TABLE T-TEST SCORES BETWEEN CATEGORIES

	I & IIa	**I & IIb**	**I & IIc**	**IIa & IIb**	**IIa & IIc**	**IIb & IIc**
Initial GCS	7.78 ^{xx}	9.24^{xx}	11.02^{xx}	1.47	3.88^{xx}	2.94^{xx}
Deterioration GCS	14.95 ^{xx}	43.94^{xx}	-	1.72	-	-
Volume	17.46 ^{xx}	18.00^{xx}	31.96^{xx}	2.94^{xx}	10.59^{xx}	18.81^{xx}

xx – Significant of .01 Level

TABLE – 27

CORRELATION SCORES

	Initial GCS	**Deterioration GCS**	**Volume**
Initial	1.00	0.259^{xx}	-0.812^{xx}
Deterioration		1.00	-0.107
Volume			1.00

xx - P < .01 x – P< 0.05

DISCUSSION

(A) Lesion volume :- As already observed in the previous sections, GrI patients with lesion volume of 30ml or more were observed to have radiological evidence of herniation in 100% of patients. This, on the one hand prompted to conclude that the usually accepted lesional threshold volume (30ml) exerted its influence on outcome through the mechanism of herniation. This is indirectly supported by the fact that decompression has helped this group to reduce the mortality (17.2%). On the other hand it is also prompted to assume, that though the available literature evidence of lesional volume of 30ml does not clearly state that these patients have had signs of clinical and radiological features of herniation. In other words the existing literature advocating threshold lesional volume of 30ml is not an exclusive stand alone lesional volume but with lesional volume and radiological signs of herniation.

This assumption is indicated in our study by the patient population in sub group IIa. These patients initially had a lesional volume <30ml without signs of herniation. But when the lesional volume reached 30ml, they also developed radiological signs of herniation and underwent surgery to benefit

theroff. Mortality in this sub group is comparable (16.7%) with group I (17.2%).

In Group III Patients, average Volume of the lesion was the least, <10ml and they never had lesion volume increased to > 30ml and no signs of clinical (or) radiological herniation.

It is the sub group II-b, that gets specifically addressess the primary aim of this study namely lesional volume alone as a independent marker for surgical intervention. In this sub group the patients had the lesional volume of 10-29ml –on serial CT Scanning the lesional volume never reached 30ml mark. Hence they never underwent surgery as per the inclusion and exclusion criteria of this study. They had the maximum mortality among all the groups. Among the patients of this sub group who survived it is seen that radiological signs of herniation were present in 40% of cases. Among the patients in this sub group it is seen that 7 out of 12 patients (60%) had signs of radiological herniation at the time of death.

As per the protocol of this study, they were subjected to medical decompression irrespective of presence of radiological signs of herniation as

the lesional volume never reached >30ml. obviously this is not an adequate parameter.

Hence we sub divided that Gr IIb into two cluster. Cluster IIb (1) of 7 patients who died with conservative management. Cluster IIb (2) who survived with conservative management. We further analysed this with respect to median lesional volume and radiological signs of herniation.

Median Volume

	IIb(1)	**IIb(2)**
Initial	20ml	20 ml
Deterioration	26ml	21.8ml

From this it is seen that patients with median threshold volume of 21.8ml though they survived without surgery, they had residual deficit due to herniation and had to undergo repeated CT Scans and spent maximal number of days in hospital stay. Hence, 20 ml which is the median presenting volume in the sub group IIb (1) (Before radiological signs of herniation) is identified as the critical independent threshold lesional volume for surgical intervention. So we propose this value as a new bench mark for Traumatic Temporal lobe lesions in adults for surgical intervention.

In an effort to use this value to be universally acceptable , we measured the supratentorial volume of equal number of adult male and female skulls and obtained the average.(male 1200ml-1257ml with average 1231.2ml) (Female 1015ml -1050ml with average 1034.5ml).

Taking the mean average of STC volume in our population, we compared it with the average adult Temporal lobe lesional volume and arrived at an index as per the following.

$$\text{Supratentorial Temporal lobe lesion index} = \frac{\text{lesion volume}}{\text{Supratentorial cranial volume}}$$

$$= \frac{22\text{ml}}{1132.8.} = 0.0194209$$

which is called as the critical index of Supratentorial temporal lobe lesion index – which can be used as a formula for deciding about surgical intervention.

However for the wide use of the formulae, and to test its sensitivity, CT Scan Machines have to be equipped with softwares to calculate the intracranial volume.

(B) GCS : Average intial GCS for the entire Study Group found to be 11. Group I patients had significantly lower initial GCS than average – when compared with the remaining 3 Groups whose GCS was higher than the study Group average-but the difference was minimal. On analysis of post deterioration GCS, Group IIa, IIb patients had lower GCS when compared to average initial GCS of Study Group.

On comparing initial GCS with post deterioration GCS of IIa / IIb patients, both Groups had deteriorated by 2 scores on an average which is again a significant finding.

Long Tract Signs and bradycardia cannot be ignored. They act as warning clinical signs for close observation of lesional volume behaviour. While their absence is reassuring, their presence calls for close watch with repeated CT Scan, to see whether the threshold volume is breached. Thus their presence while by itself do not warrant surgery, they call for close observation.

Bradycardia & Long tract signs shows that it is present in a significant amount of patients in Group IIb - the group which had the worst outcome.

Hence we propose that presence of bradycardia and long tract signs should be given equal importance as anisocoria.

CONCLUSION

On concluding, the patients in the conservative group who have

1) Clot volume of 20 ml itself is an indication for surgical intervention for better outcome.
2) Critical volume index in our population is 0.019. Hence all patients with CVI more than this should be considered for surgery as first line of management.
3) Average initial GCS for the entire study group found to be 11. On comparing the initial GCS with post deterioration GCS, GCS deterioration by 2 scores than initial GCS (Average Score of 11) to be given much importance.
4) Onset of Bradycardia ,Long Tract Signs should be given much more importance in deciding about surgical intervention,

should undergo surgery as an initial management option, inorder to obtain better prognosis and out come.

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